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Photovoltaics Program  
Technology Development and Applications  
Lead Center

# Photovoltaic System Criteria Documents

Volume IV: Review Criteria for Photovoltaic Applications

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## SECTION I

## INTRODUCTION

## A. GENERAL

## 1. Purpose

The purpose of this document is to provide guidelines for the organization, preparation and conduct of program reviews for photovoltaic applications.

## 2. Scope

These criteria apply to all photovoltaic applications. They include, but are not limited to, the following:

~~/1-~~ Conceptual design review

~~-~~ Preliminary design review

- Critical design review

- Operational readiness review

## 3. Objective

The objective of this document is to assure that contract goals and objectives are met through program monitoring for cost, schedule and performance for both managerial and technical elements for all PV applications activities.



## SECTION II

## CRITERIA FOR THE REVIEW PROGRAM

## A. ORGANIZATION

The Field Center program manager is responsible for establishing and co-chairing the design reviews, including the selection of the Design Review Board membership. D/R Board members may be selected from the Field Center, DOE Photovoltaics Lead Center, other sources as appropriate. The Board Chairman should see that D/R packages (including drawings) are furnished to the Board members two weeks prior to convening of the Board.

The findings of a Design Review Team almost always include action items which result when inadequate resolution of problems prevents concurrence in the design by the Design Review Board. The Board's output provides recommendations to the program manager. These action items and other agreements are entered into minutes which form the basis for monitoring progress of the design and action items. The Board Chairman will provide a written report of the action items along with a schedule of resolution and any recommendations to all Board members. A sample Action Item Form is shown in the figure on page 2-2.

Depending on the evolutionary stage of an application, the general schedule for conducting reviews is:

- a. Conceptual D/R: Usually within three months of Task start.
- b. Preliminary D/R: At conclusion of systems pre-design. (Sometimes a. and b. are combined or either one serves both purposes).
- c. Critical D/R: At completion of detail design.
- d. Hardware/Site Readiness Review: At completion of all subassembly fabrication, site construction, and prior to shipment/installation at site.
- e. Operational Readiness Review: Prior to long-term system operation.

## 2. Convening Authority

The Field Center as the convening authority should:

- a. Appoint a Review Board
- b. Prepare and issue a written Review Board charter
- c. Establish schedule constraints for the review activity.

## ACTION ITEM

CONTROL NO. \_\_\_\_\_

DATE OF MEETING		SUBJECT:		LOCATION	
ACTION REQUIRED/COMPLIANCE				DUE DATE: _____	
_____					
_____					
_____					
ASSIGNED TO:		ORIGINATOR			
		AGENCY			
FOLLOW UP					
STATUS: _____					
_____					
ASSIGNEE:					
DATE COMPLETED:			DOCUMENT NO.		
COORDINATORS			TECHNICAL APPROVAL		
PHONE	AGENCY		SIGNATURE	DATE	
PHONE	AGENCY		SIGNATURE	DATE	
PHONE	AGENCY		SIGNATURE	DATE	
PROCURING ACTIVITY	DATE	CONTRACTOR	DATE	CONTRACTS	DATE

Figure. Sample Action Item Form



- d. Make certain that the project manager of the activity to be reviewed includes formal review milestones in his schedule which permit ample time for incorporation of accepted recommendations of the Review Board.
- e. Provide necessary financial support to the Review Board in relation to its charter.
- f. Receive and respond to recommendations from the Review Board.

Finally, it is to be noted that the recommendations of the Review Board are advisory. The responsibility for accepting, rejecting or acting in part on the Board's recommendations rests with the convening authority, intended here to mean the Field Center.

### 3. Review Board Staffing Selection

The composite capability of the Review Board should be appropriate to the scope of the activity being reviewed. Consultants other than Field Center employees may be used if necessary.

It is suggested that in staffing the Review Board, the convening authority first select a chairman, so that the chairman can participate in selecting the other members of the Board.

The voting members of a Review Board should not be selected from the team or the management directly responsible for performing the work under review.

### 4. Review Board Charter

The charter is of paramount importance. It is recommended that the Field Center prepare a first draft of the charter before selecting a chairman, and then proceed with a final draft through collaboration with the chairman before selecting the other members of the Review Board.

A statement should be included in the charter to the effect that the chairman of the Review Board shall be responsive only to the convening authority in the conduct of his assignment.

While the responsibility for the formulation of the Review Board's charter rests solely with the field center, the following items are examples of the types of responsibilities and objectives that would be appropriate for inclusion in the charter:

- Examine the technical feasibility of the photovoltaic system application under review, including identification of functions which require a bridging interface with research and advanced development photovoltaic/photovoltaic-thermal programs in process.

- Evaluate the proposed work breakdown structure, including internal and external interfaces.
- Determine the validity of the cost estimate based on the extent and scope of the architectural design and the cost estimation methodology.
- Assess the proposed implementation and operational modes of the PV and photovoltaics applications.
- Evaluate the cost, schedule and performance risks which would have to be assumed by the Field Center.
- Review and critique management arrangements with other centers and organizations.
- Review and critique preliminary implementation plans for the project.
- Review and critique the make-or-buy plans.
- Review and critique the program contingency plans.
- Review and critique the status of all design elements of the project and plans for the cost review.

## B. RESPONSIBILITIES

### 1. Contractor

The contractor project manager participates in the design reviews and is responsible for the following:

- Establishing the time, place, and agenda for each review in consonance with the master milestone schedule, subject to coordination with the Field Center.
- Designating a co-chairman (normally the Field Center program manager or his designated representative.)
- Preparing/coordinating official meeting minutes. Minutes will be recorded only as dictated by either co-chairman and will consist of significant questions and answers, action items, deviations, conclusions, and recommended courses of action resulting from presentations or discussions.
- Provide in the minutes with each action item a schedule of resolution, assignee, and any recommendations.
- Provide the FCPM Lead Center Review Board members a data package (plans, drawings, trade study results, etc.) as appropriate a minimum of two weeks prior to convening the review.

## 2. Field Center

The Field Center program manager's participation is as follows:

- Serves as co-chairman.
- Provides the name and organization of each review board members to the contractor project manager prior to each review.
- Provides formal acknowledgement to the contractor of the accomplishments of each review after receipt of the review meeting minutes and establishes the adequacy of the contractor's review (viz, approval, contingent approval, disapproval).

## C. REVIEWS

## 1. Conceptual Design Review

Representative items to be reviewed include the results of the following (as appropriate):

- Summary of conceptual system design consideration
- Evaluation of cost, performance, availability
- Advantages of concept

Sensitivity to terrain  
 Array profile (wind load, etc.)  
 Cost of particular collector/array concept  
 Attractiveness of concept/site

- Features of concept

Levelized economic benefits  
 Proven/demonstrated collector features

- Application/site description

- System design requirements

Environment  
 Life  
 Local (civil) requirements/codes  
 System electrical output (thermal)  
 Photovoltaic system area (acreage)

- System definition

Array types  
 Power conditioning  
 Utility interface  
 Safety  
 Operating modes

- Subsystem definition/requirements

- Solar array subsystems
  - Electrical subsystems
  - Field subsystems
  - Instrumentation (for measurements)

- Performance analysis (system)

- Economic analysis (system)

- Trade studies

## 2. Preliminary Design Review

The major categories to be covered in the PDR are program control/management, technology, procurement, operations, and safety. The details within these categories are much the same as will be sought in the Critical Design Review. The following list should serve as a model for consideration in PDR and CDR.

### SUGGESTED CHECKLIST FOR DESIGN REVIEWS

#### Management

- Organization: task breakdown structure, responsibilities, internal/external reporting scheme
- Program overview: detailed milestone/cost schedule
- Problem areas: redirection, action items, other

#### Technical (for systems, subsystem and site tasks reporting, as applicable)

- Design: requirements, detailed system block diagram and description, system size rationale, specification, drawings.
- Performance analysis: requirements, system losses/degradation, predictions.
- Trade-offs: cost/schedule/performance impacts
- Problem areas: action items, other

#### Procurement

- Site construction: description, schedule
- Hardware: availability, cost, schedules
- Quality assurance: acceptable criteria, control methods
- Shipping/storing: control methods

- System checkout: criteria, procedures, test plans

#### System Operation

- Organization: training, manuals, responsibilities, reporting scheme.
- Performance evaluation
- Problem areas: sensitivities (technical, urban)

#### Safety (personnel and equipment)

- Hazard checklist: preventive measures
- Documentation: requirements, procedures, regulations
- Control: responsibilities
- Problem areas

### 3. Critical Design Review

The equipment and facilities detail designs as presented in the product specifications, drawings, schematics, etc., will be reviewed against the development specification performance requirements. Upon satisfactory demonstration that the design will satisfy the requirements the contractor will be permitted to fabricate equipment in accordance with the Detail Design presented at the CDR. (Use the Design Revision Checklist above for CDR guide).

### 4. Hardware/Site Readiness Review

In the H/SRR, major emphasis will be on documentation of hardware and site readiness. The following items will be included for review:

- a. Status of D/R action item
- b. Test data
  - Quality control verification
  - Inspection report
- c. Site and hardware
  - Drawings
  - Specifications
  - Technical data
  - Tests utilized in production

- Released engineering documentation associated with fabrication of the items
- Quality controls records to verify as-built configuration
- Environmental plan (impact statement)
- d. Plans and procedures for site activities
  - Safety
  - System/subsystem intermediate checkout
  - QA surveillance
- e. Program goals review

A comprehensive hardware/site readiness review should provide satisfactory answers to the following types of questions:

- Are all drawings and specifications complete, approved and released?
- Do the released drawings and specifications reflect all approved changes?
- Does the equipment meet the requirements of the interface control drawings?
- Have all discrepancies and Material Review Board actions been dispositioned and agreed-to by Engineering and QA?
- Has complete as-built list information been submitted to the field center?
- Is all (required) testing completed?
- Is there anything about this equipment which would make one reluctant to commit it to site installation?
- Are there any Engineering Change Requests against this equipment that have not been closed?
- Which waivers apply to this equipment?
- Are there any Problem/Failure Reports still open?

#### 5. Operational Readiness Review

Representative items for ORR should consider the following:

##### Management

Organization  
Permits/licenses/agreements

Goal assessments

Commercial application  
Public visibility  
Total energy concept  
PV system technology

Site audits (refer to Volume III, Site Audit Criteria document)

Schedules  
Data acquisition  
Data evaluation  
Record-keeping  
Instrumentation system  
Technical performance (projected)  
Economic performance (projected)

Non-technical data

Visitor reactions  
Financial  
Environmental aspects

Maintenance and repair

Training  
Procedures/plans: battery checks, arrays checks  
Down-time projection  
Record-keeping  
Reliability plan  
Spares plan

Environmental analysis

Recording methods

Test and acceptance results

QA verification  
Discrepancies

Safety

Training  
Equipment: showers, eyewash, masks, gloves  
Lightning protection  
Fencing/security  
Battery venting  
Provisions for array/array and array/battery disconnects  
Flame arrestors

